International Journal of Agricultural Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 9, Issue 4, Aug 2019, 131-136

TRANS STELLAR
•Journal Publications •Research Consultancy

Original Article

AN EFFECT OF ORGANIC AND INORGANIC NUTRIENTS ON GROWTH, YIELD OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) AND SOIL FERTILITY IN AN ALFISOL OF TAMIRAPARANI TRACT

A. RAJKUMAR [1] & M. PARAMASIVAN[2]

[1]*Research Scholar, Department of Soil Science and Agricultural Chemistry, Agricultural College and Research Institute, Killikulam, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India*

[2]*Assistant Professor, Department of Soil Science and Agricultural Chemistry, Agricultural College and Research Institute, Killikulam, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India*

ABSTRACT

A field experiment was conducted at Agricultural College and Research Institute, TNAU, Killikulam (TamilNadu) during Rabi season (2018 – 2019) to study the effect of organic and inorganic nutrients on growth, yield and soil fertility of groundnut variety TMV 13 in an Alfisolof Tamiraparani tract. The experiment was laid out in randomized block design (RBD) replicated thrice with ten treatments. Application of 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} (T_8)produced significantly tallest plant (66.56 cm), number of branches plant^{-1} (7.94), days to 50% flowering (30.50), number of pods plant^{-1}(66.08), weight of pods plant^{-1} (70.95 g), hundred kernel weight (36.02 g), pod yield (2938.17 kg ha^{-1}) and haulm yield (8936.50 kg ha^{-1}). Significant built up of organic carbon (0.69 %), available N (278.32 kg ha^{-1}), available P (16.53 kg ha^{-1}) and available K (298.63 kg ha^{-1}) were also registered with the application of 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}(T_8).

KEYWORDS: Alfisol, Groundnut, Biofertilizers, Organic Manures, Seed Yield & Available Nutrients

Received: May 08, 2019; **Accepted:** May 29, 2019; **Published:** Jun 19, 2019; **Paper Id.:** IJASRAUG201917

INTRODUCTION

Groundnut (*Arachishypogaea* L.) is one of the most important oilseed crops in native to South America. It is grown in all over the world and commonly accounts the 'king of oilseed'. In Tamil Nadu, it is cultivated in the area of 282 thousand hectares with the production of 582 thousand tonnes with the productivity of about 2.08 t ha^{-1}(DAC, GoI. 2017)[1]. Groundnut seed is valued both for its oil and protein content as contain about 50 per cent oil, 25-30 per cent protein, 20 per cent carbohydrate and 5 per cent fiber and ash which make a substantial contribution to human nutrition. Combined use of Poultry manure, Rhizobium and Humic acid with NPK improve the productivity and soil fertility. Poultry manure contains all the essential plant nutrients and it is an excellent organic manure, as it contains high essential nutrients. Rhizobiumspp inoculants have favourable effect on legumes like groundnut. Inoculation with rhizobium improves nodulation which enhance N fixation and activation of amino acids for synthesis of carbohydrates. Humic acid (HA) is a vital constituent and an intimate part of soil organic structure and improving soil properties and plant growth. The continuous and imbalanced use of chemical fertilizers alone resulted in deterioration of soil health and lower productivity of groundnut. There is need for

enriching the soil health with organic matter to enhance productivity of groundnut. Though the organic amendments and biofertilizers help to provide nutrients to crop growth but it cannot be replace the inorganic fertilizers. Hence, integrated use of both nutrients to be attain more productivity of groundnut and sustaining soil health. Therefore, the present investigation was under taken to study the effect of organic and inorganic nutrients on growth, yield of groundnut (*Arachishypogaea* L.) and soil fertility in an Alfisol of Tamiraparani tract.

MATERIALS AND METHODS

A field experiment was conducted of Agricultural College and Research Institute, Killikulam, Thoothukudi during the Rabi season November 2018- February 2019. The soil of the experimental field was sandy clay loam (Scl) in texture having nearly neutral in reaction (pH 6.7), low in organic carbon **(**0.49 %**)**, low in available nitrogen (225 kg ha^{-1}), medium in phosphorus (11 kg ha^{-1})and medium in potash (235.5 kg ha^{-1}). The cation exchange capacity of the soil was 20 c mol (p+) / kg. The bulk density of the soil was 1.29 Mg/m^3. The soil was taxonomically grouped as Rhodustalfs (Rajavel, 2000)[2]. The experiment consisted of ten treatments *viz.,* T_1 – 100% STCR @ 38 : 64 : 94 kg NPK ha^{-1}, T_2 – 75% STCR + Poultry manure @ 3 t $ha^{-1,}$ T_3 – 75% STCR + Rhizobium @ 3 kg ha^{-1}, T_4 – 75% STCR + Humic acid @ 20 kg ha^{-1}, T_5 – 75%STCR + Humic acid @ 20 kg ha^{-1} + Rhizobium @ 3 kg ha^{-1}, T_6 – 75% STCR + Rhizobium @ 3 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}, T_7 – 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}, T_8 – 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}, T_9 - Poultry manure @ 3 t ha^{-1}, T_{10}- Control was carried out in randomized block design (RBD)with three replication. The groundnut variety TMV 13 was taken as test crop. Sowing of groundnut was done during first week of November with the spacing 30 × 10 cm. The cultivation practices were followed as per the guidance of Crop Production Guide of Tamil Nadu Agricultural University [3]. The fertilizer sources used were urea for N (46% N), single super phosphate for P (16 % water soluble P_2O_5), muriate of potash for K (60% of SO_4). Growth and yield attributes were recorded as per standard procedures. Five representative samples of each plot were collected and observations of biometric and yield attributes such as plant height, number of branches $plant^{-1}$, days to 50% flowering, number of pods $plant^{-1}$, number of matured pods $plant^{-1,}$ number of immatured pods $plant^{-1,}$ weight of pods $plant^{-1}$, hundred kernel weight, pod yield, and haulm yield and dry matter production were statistically analysed. The nutrient content and uptake by plant were analysed through standard procedures.

The post harvest soil samples were collected from 0 – 30 cm depth for analysing for physical and chemical parameters and available nutrient status. Soil samples were analysed for alkaline permanganate oxidizable N, 0.5 M $NaHCO_3$ – extractable P and 1 N NH_4OAC – exchangeable K. Two- way analysis of variance (ANOVA) was performed for traits for seasons and the combined (Pooled) over seasons after testing error variance homogeneity was carried out to the procedure outlined by Gomez and Gomez, (2010) [4]Statistical package. Significance difference between the treatments were compared with the critical difference at (± 5 %) probability by LSD.

RESULTS AND DISCUSSIONS

The results obtained from the present investigation as well as relevant discussion have been summarized and concluded under following heads:

Growth and Yield Attributes

The plant height was measured and recorded at harvest(table 1). The height of the plant significantly differed for various treatments. The ranges of the plant height were 44.60 to 66.56 cm at final harvest. At harvest, the tallest plants

(66.56 cm) were recorded in the treatment (T_8) with 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} followed by treatment (T_7) with 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}had recorded next tallest plant (58.77 cm). The increase in plant height was significant due to recommended NPK along with Rhizobium, poultry manure and humic acid. This could be due to supplying N, P and K nutrients in proper proportion through soil application. These results are in conformity with the findings of Zalate and Padmani (2009) [5]. The shortest plant (44.60 cm) was recorded in absolute control(T_{10}). The number of days required for 50% flowering of the crop was assessed in all the treatments. Among the treatments (T_8) with 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} had achieved the 50 % flowering at the earliest (30 days) followed by the treatment (T_7) with 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}, which reached the 50 % flowering earlier (31 days). Both the treatments were on par with each other. The 50 % flowering was late (39 days) in the control (T_{10}). This might be due to proper growth of groundnut, which enhanced the earliest flowering as 50 %. The yield attributes parameters like number of pods $plant^{-1}$ and weight of pods $plant^{-1}$, were significantly influenced for various treatments. Among all the treatments, maximum number of pods$plant^{-1}$(66.08) and weight of pods $plant^{-1}$(70.95 g) was recorded in the treatment applied with 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} (T_8) followed by the application of 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} (T_7) recorded the higher number of pods$plant^{-1}$(52.87) and weight of pods $plant^{-1}$(61.98 g). These treatments were on par with each other. The minimum number of pods$plant^{-1}$(25.42) and weight of pods $plant^{-1}$(27.04 g) was registered in control (T_{10}). Adequate supply of N, P, K, humic acid, poultry manure and rhizobium were enhanced the availability at critical growth stages resulted in enhanced yield characters *viz.,* number of pods $plant^{-1}$, weight of pods $plant^{-1}$ and 100 kernel weight. These results are in agreement with Shankar Lal Choudhary *et al.,* (2017) [6].

Table 1: Effect of Organic and Inorganic Sources of Nutrients on Growth and Yield Attributes of Groundnut

Treatments	Plant Height (cm)	No. of Branches $Plant^{-1}$	Days to 50 % Flowering	No. of Pods $Plant^{-1}$	Weight of Pods per Plant (g)	Pod Yield (kg ha^{-1})	Haulm Yield (Kg ha^{-1})
T_1 – 100% STCR @ 38 : 64 : 94 kg NPK ha^{-1}	53.20	7.28	35.58	45.75	49.68	2464.40	7396.25
T_2 – 75% STCR + Poultry manure @ 3 t ha^{-1}	54.36	7.28	36.60	36.60	38.56	2210.74	6637.82
T_3 – 75% STCR + Rhizobium @ 3 kg ha-^{1}	53.74	7.06	36.60	34.57	43.09	2299.19	6943.33
T_4 – 75% STCR + Humic acid @ 20 kg ha^{-1}	49.68	6.62	35.58	39.65	44.40	2463.89	7440.98
T_5 – 75% STCR + Humic acid @ 20 kg ha^{-1} + Rhizobium @ 3 kg ha^{-1}	58.01	7.37	34.57	51.85	59.51	2668.75	8514.58
T_6 – 75% STCR + Rhizobium @ 3 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}	47.21	7.34	38.63	48.80	57.01	2147.71	6481.25
T_7 – 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}	58.77	7.62	31.52	52.87	61.98	2775.50	8824.67
T_8 – 75% STCR +	66.56	7.94	30.50	66.08	70.95	2938.17	8936.50

Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}							
T_9 - Poultry manure @ 3 t ha^{-1}	54.48	7.04	34.57	40.67	56.02	1788.83	5366.48
T_{10}- CONTROL.	44.60	5.84	39.65	25.42	27.04	1530.08	4833.74
SEd	0.50	0.16	0.31	0.72	0.79	26.65	85.03
CD (P=0.05)	1.06	0.34	0.65	1.51	1.67	56.00	178.65

Yield

Application of humic acid, poultry manure and rhizobium at different methods with recommended dosage of NPK and STCR – NPK in groundnut significantly enhanced the pod and haulm yield of groundnut compared to control. The application of 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} (T_8) produced the maximum pod and haulm yield (2938.17 kg ha^{-1}and8936.50 kg ha^{-1}, respectively) which was significantly higher compared to control. The second best treatments was 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} (T_7) which was also recorded the pod and haulm yield (2775.50 kg ha^{-1}and 8824.67 kg ha^{-1}respectively), whereas lowest yield of pod and haulm yield (1530.08 kg ha^{-1}and4833.74 kg ha^{-1}, respectively) was noticed with no application of fertilizer (control). The increase in pod and haulm yield might due to increased growth and yield attributes. This might be due to adequate and steady supply of all nutrients to plants at all stages of crop growth. This corroborates the earlier reports of Snehal *et al*., (2014) [7] and Manisha Basu *et al.,* (2008)[8].

Soil Fertility

Perusal of data presented in table 2 revealed that the available nutrient status at post harvest soil were influenced for various treatments. The highest values of organic carbon, nitrogen, phosphorus and potassium (0.69 %, 278.32 Kg ha^{-1}, 16.53 Kg ha^{-1}, 298.63 Kg ha^{-1}) were recorded with the treatment with 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}(T_8). These results are in agreement with Vala*et al.,* (2018)[9] and Akbari*et al.,* (2011)[10]. The lowest values of organic carbon, nitrogen, phosphorus and potassium (0.43 %, 182.90 kg ha^{-1}, 8.77kg ha^{-1},187.56kg ha^{-1}) were recorded for control.

Table 2: Effect of Organic and Inorganic Sources of Nutrients on Soil Fertility of Groundnut

Treatments	Organic Carbon (%)	N (Kg ha^{-1})	P (Kg ha^{-1})	K (Kg ha^{-1})
T_1 – 100% STCR @ 38 : 64 : 94 kg NPK ha^{-1}	0.62	237.54	12.44	246.69
T_2 – 75% STCR + Poultry manure @ 3 t ha^{-1}	0.48	231.23	14.10	235.93
T_3 – 75% STCR + Rhizobium @ 3 kg ha-^{1}	0.53	234.19	11.75	245.65
T_4 – 75% STCR + Humic acid @ 20 kg ha^{-1}	0.53	230.22	11.30	264.32
T_5 – 75% STCR + Humic acid @ 20 kg ha^{-1} + Rhizobium @ 3 kg ha^{-1}	0.68	253.60	13.46	279.37
T_6 – 75% STCR + Rhizobium @ 3 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}	0.65	241.03	11.50	267.25
T_7 – 75% RDF + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}	0.68	256.50	14.31	283.33
T_8 – 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1}	0.69	278.32	16.53	298.63
T_9 - Poultry manure @ 3 t ha^{-1}	0.67	227.57	11.84	263.62
T_{10}- CONTROL.	0.43	182.90	8.77	187.56
SEd	0.020	9.46	0.19	3.34
CD (P=0.05)	0.043	19.88	0.41	7.02

RDF: Recommended dose of fertilizer for groundnut (25:50:75 kg of NPK ha^{-1})

STCR: Recommended dose of fertilizer in soil test crop response for groundnut (38:64:94 kg of NPK ha^{-1})

CONCLUSIONS

Based on the results of the present study could be concluded that the groundnut showed greater response to the application of 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1} + Poultry manure @ 3 t ha^{-1} gave significantly maximum growth and yield characters. This combination also provides good quality produce and maintaining the soil health.

REFERENCES

1. *DAC GoI. (2017) Agricultural Statistics at a Glance. Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. New Delhi. (http: // agricrop.nic.in).*
2. *Rajavel K. (2000) M. Sc.(Ag.) Thesis. Tamil Nadu Agricultural University, Coimbatore.*
3. *Crop Production Guide (2015) Tamil Nadu Agricultural University, Coimbatore.*
4. *Gomez K. A and Gomez A. A (2010) Edition 2. p 680. John Wiley and Sons, New York.*
5. *Zalate, P. Y. and D. R. Padmani. 2009. Effect of organic manure and biofertilizers on growth and yield attributing characters of kharif groundnut (Arachishypogeae L.). International Journal of Agricultural Sciences, **5** (2) : 343 – 345.*
6. *Shankar Lal Choudhary, O. P. Sharma, M. K. Gora and R. R. Choudhary. 2017. Effect of organic manures and molybdenum on growth, yield and quality of groundnut. International Journal of Current Microbiology and Applied Sciences. **6** (1) : 736 – 742.*
7. *Snehal, R. Patil, Swati, R. Kadam, N. K. Kalegore and P. R. Dadgale. 2014. Effect of inorganic and biofertilizers on growth and yield of summer groundnut. Advance Research Journal of Crop Improvement, **5** (1) : 23 -25.*
8. *ManishaBasu, P. B. S. Bhadoria and S. C Mahapatra. 2008. Growth, nitrogen fixation, yield and kernel quality of peanut in response to lime, organic and inorganic fertilizer levels. Bioresource Technology, 99: 4675 – 4683.*
9. *Fekkoun, S., Doumandji, S., & Ghezali, D. (2014). Influence of Few Farming Techniques on the Mite Soil Biodiversity in the Plain of Mitidja (Algeria). International Journal of Agricultural Science and Research (IJASR), 4(6), 11-15.*
10. *Vala F. G., P. M. Vaghasia, K. P. Zala and N. Akhatar. 2018. Response of INM on nutrient uptake, economics and nutrient status of soil in bold seeded summer groundnut. International Journal of Current Microbiology and Applied Sciences, 7 (1) : 174 – 180.*
11. *Akbari K. N., M. V. Ramdevputra, G. S. Sutaria, V. D. Vora and D. R. Padmani. 2011 Effect of organics, bio and inorganic fertilizer on groundnut yield and its residue effect on succeeding wheat crop. Agricultural Research Communication Centre, 34 (1): 45 – 47.*